Jan. 21, 1936. H. B. HENDERSON ET AL 2,028,507

PYROMETRIC DEVICE

Filed April 30, 1935

Fig. 1.

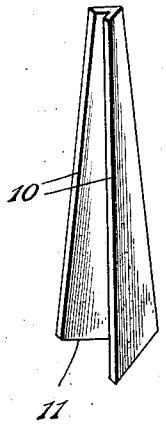


Fig. 2.

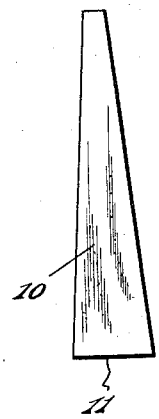


Fig. 3.



Fig. 4.

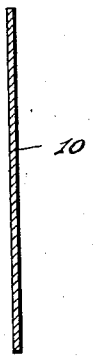
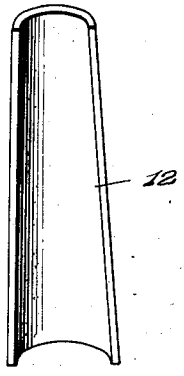


Fig. 5.



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PYROMETRIC DEVICE

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5 Claims. (Cl. 73—32)

This invention relates to an improved pyrometric device and seeks among other objects, to provide a reliable indicator of heat work. Heretofore, pyrometric cones, so called, have been designed primarily as heat indicators so that by observing the cone during the course of firing, the temperature of the kiln could be reasonably gauged. Such cones have proven unsatisfactory, however, for many reasons chief among which is the fact that due to the thickness or mass of said cones they are not uniformly affected by kiln gases with the result that a refractory skin is sometimes formed on the exterior of the cone while the interior thereof develops a cellular structure. The cone thus assumes a bi-refractory characteristic and such cones do not behave uniformly under actual firing conditions, with consequent inaccuracy. It may also be mentioned that the usual solid cones have a tendency to bloat and due to their bi-refractory characteristics tend to melt and bend at widely different kiln temperatures and are accordingly inaccurate.

Instead of the inaccurate method of gauging the extent of heat work in the kiln by providing a cone intended to function as a heat indicator, the present invention is predicated upon a direct approach to the object of measuring the actual work done by the kiln temperature and seeks in this way, to provide a dependable guide to the firing of ceramic ware.

A further object of the invention is to provide a device which, for given size and thickness consistent with stability, will have a maximum of surface exposed for contact by kiln gases, so as to take advantage of the various chemical changes and compounds produced by contact with these gases whereby reaction, which proceeds from the surface toward the interior, can be completed in time proportional to the surface area.

A further salient object of the invention, therefore, is to provide a device wherein its entire inner surface, practically speaking, as well as its entire outer surface will be exposed to the free circulation of kiln gases, wherein the walls of the device will be thin so that the reaction of the kiln gases may proceed inward from both surfaces of said walls to penetrate the entire mass so that the device will thus be mono-refractory and wherein at least one wall of the device will be of uniform density and thickness throughout at least one dimension of the device to provide for accurate registry of heat work.

And the invention seeks, as a still further object, to provide a device of a shape adapted to accurate as well as easy manufacture, which can stand handling and such that the device will be capable of standing upright in practical use, and wherein the chemical reactions resulting in softening and fusion may proceed without disrupting the mass of the body of the device to thus provide a reliable guide for the control of the heat treatment of ceramic ware.

Other and incidental objects of the invention will appear during the course of the following description and in the drawing forming part of this application;

Figure 1 is a perspective view of my improved device.

Figure 2 is a side elevation of the device.

Figure 3 is a transverse section.

Figure 4 is a longitudinal section taken medially through one of the wings of the device.

Figure 5 is a perspective view showing a variation in the shape of the device.

In carrying the invention into effect, our improved pyrometric device may be formed in any one of a number of different shapes meeting the requirements of the invention and in Figures 1 to 5 inclusive of the drawing, we have shown a device the body of which is V-shaped in cross section. The body of the device thus comprises diverging wings 10 integrally connected at their meeting longitudinal edges. As particularly brought out in Figure 2, each of the wings 10 is tapered in width towards its upper end so that in side elevation, the body of the device is of frustro-pyramidal shape. This longitudinal tapering of the body of the device is adopted because of the gravitational action in bending under the influence of kiln temperatures, as to accomplish bending at thermal uniformity, the mass of the tip of the body must be a minimum and the mass of the body must gradually increase towards the base of the body which base serves, in the practical use of the device, as a fulcrum. The cross sectional V-shape of the body in conjunction with the gradual widening of the wings 10 toward the base also imparts stability to the device and resistance to fracture, particularly near the base of the body where it might snap off.

The base of the body is, of course, the surface or surfaces thereof upon which the body rests when arranged in operative upright position upon the usual holding plaque within a kiln and in this connection, it should be noted that it is imperative the base be of such contour as to firmly support the device in such upright position. Thus, in the instance of the cross-sectional V-shaped

device, the long bottom edges 11 of the wings 10 provide the base of the body and, due to the divergence of said edges these edges will, as will be appreciated, rigidly support the body upright. It should be noted, however, that the bottom edges of the side wings 10 are tilted or inclined so that the body of the device thus normally sets at a slight angle, possibly 8° more or less from the vertical, this being done to enhance the thermally accurate bending of the device in practical use.

The device may be formed of any suitable plastic or stiff mud and any approved process may be followed in producing the device. It should be noted, however, that a V-shaped body, as shown, is eminently suitable for manufacture by machinery through the use of suitable dies, as by pressing or extrusion methods, in that the device does not possess any pockets or obstructing walls.

Attention is now particularly directed to the fact that the wings 10 are thin and that each of these wings is of uniform thickness and density throughout the length thereof. These characteristics in a pyrometric body in conjunction with stability and the provision of wholly exposed inner and outer surfaces of a body adapted to stand upright constitutes perhaps the most salient feature of the present invention and in using the term "thin" herein as applied to the wings or walls of the body, a thickness not exceeding a maximum of $\frac{3}{32}$'' is contemplated. Uniformity of thickness and density may readily be obtained by pressing the body in a mold adapted to exert a uniform pressure on the body so that the device may thus be manufactured with accuracy.

As will now be perceived, the body of the device provides a structure wherein, for given size, a maximum area is exposed to direct circulation of and contact with kiln gases whereby reaction can be completed in time proportional to the surface area of a wall thickness of uniform thinness and density. Advantage is thus taken of the various chemical changes and compounds produced by contact of those kiln gases which in the use of conventional pyrometric cones are frequently injurious. As will also be perceived, the body of the device provides a structure wherein the kiln gases will not be entrapped by the device. In other words, the kiln gases may freely circulate about the wings 10 of the body at both sides of said wings and throughout the length thereof to directly act upon the entire vertical surfaces of the wings.

At this point, it should be noted that in the use of conventional thick pyrometric cones, kiln gases penetrate the exposed surface thereof to a shallow depth only and change the character of the surface material to produce a refractory shell. Thus, in the kiln, the ordinary thick pyrometric device possessing no uniformity of mass in any dimension, assumes, contrary to the results desired, a makeup of an outer refractory shell and an inner cellular mass. Such a bi-refractory device does not behave dependably under practical firing conditions nor is it a reliable guide in kiln firing. Furthermore, certain gases under some kiln conditions react with the surface material of a conventional pyrometric device to cause such a change in the material that the device will melt or fall at erratic and entirely different temperatures than when said gases are absent.

In this connection, it is also to be noted that all so-called pyrometric cones contain an organic binder to impart the necessary working quality to the material in molding and to give the finished device sufficient strength when dry to withstand shipping and handling. This organic material is sometimes entrapped in the heavy thick part of the cone and as the temperature in the kiln rises and gases are developed, swelling and bloating of the cone occurs in the thicker portion thereof. Also, the usual cone bodies contain mineral carbonates which give off gas on heating as do oxides of minerals when combining to form other minerals during fusion. Fusion like oxidation proceeds from the outside of the cone body toward the center and as the fusion progresses, the body shrinks and becomes denser, sealing the interior to produce the well known effect of an outer refractory shell and an inner cellular core.

In contrast, thin walls of uniform density and thickness exposed to the free circulation of kiln gases, as in the present invention, offer a maximum of uniformly exposed surfaces to in turn assure a maximum change in the material of the body by absorption and reaction of the surrounding atmosphere. Due to the thinness of said walls, fusion or oxidation can proceed from both sides thereof to penetrate the entire thickness of said walls while the decomposition products have a chance to escape so that there is no swelling or bloating. Fusion may accordingly proceed without disrupting the body of the device and as the kiln gases will completely penetrate the thickness of the walls thereof, the entire thickness of said walls will become uniform in composition and no cellular core will develop. The device of the present invention is thus monorefractory and advantage is thus taken of the action of the kiln gases to provide a dependable guide to the firing of ceramic ware in instances where conventional pyrometric cones will not function in a dependable manner.

Exhaustive tests have demonstrated that a pyrometric body having a thin wall of uniform thickness and density, wherein the body is scientifically constructed to stand upright and attain proper bending upon fusion, and wherein the kiln gases may have a free circulation about a maximum surface of the walls of said body at both sides of said walls, provides a pyrometric device capable of complete thickness penetration by the kiln gases to convert the body into a monorefractory substance, the thin walls being uniformly affected under substantially all kiln conditions. When the fusion temperature of the refractory material of the body is attained, the body will bend normally. This will occur at a higher temperature than the normal bending of conventional pyrometric devices but this feature is of no importance as it is only necessary to designate a higher index for the thin walled device of the present invention or the user of the device may select by trial, the proper device for this kiln.

In Figure 5 of the drawing, we have shown a variation in the shape of the device wherein the body 12 thereof is semi-circular in cross section. As will be observed, when the device is arranged in upright position upon the usual holding plaque, kiln gases may freely circulate about the walls of the device at both sides thereof. Except as to shape, the device of Figure 5 of the drawing possesses all of the characteristics described in connection with the device of Figures 1 to 4 inclusive and further amplification would accordingly appear unnecessary.

Having thus described the invention, we claim:

1. A pyrometric device including a body having thin wall portions lying in more than one plane and providing a base adapted to support

the body in upright position, one of said wall portions having its opposite major surfaces exposed to the free circulation of kiln gases thereabout when the body is disposed upright.

2. A pyrometric device including a body having angularly disposed wall portions providing a base adapted to support the body in upright position, one of said wall portions being thin and having its opposite major surfaces exposed to the free circulation of kiln gases thereabout when the body is disposed upright.

3. A pyrometric device including a body having angularly disposed wall portions providing a base adapted to support the body in upright position, one of said wall portions being thin and of uniform thickness and having its opposite major surfaces exposed to the free circulation of kiln gases thereabout when the body is disposed upright.

4. A pyrometric device including a body having angularly disposed wall portions providing a base adapted to support the body in upright position, one of said wall portions being thin and of uniform thickness and density throughout at least one dimension thereof and having its opposite major surfaces exposed to the free circulation of kiln gases thereabout when the body is disposed upright.

5. A pyrometric device including a body having angularly disposed wall portions providing a base adapted to support the body in upright position, the mass of the body gradually increasing towards the base thereof, one of said wall portions being thin and of uniform thickness and density throughout at least one dimension thereof and having its opposite major surfaces exposed to the free circulation of kiln gases thereabout when the body is disposed upright.

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